Issues in the study of floating universal numeric quantifiers

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Abstract

In the Germanic and Romance languages (among others) a universal quantifier can combine with a numeral and form a floating quantifier. I refer to these quantifiers as universal numeric quantifiers or simply ∀NumQ. The following examples from Dutch and Romanian demonstrate this phenomenon:

Dutch

(i) a. *Alle drie de studenten hebben het boek gelezen.*
all three the students have the book read

b. *De studenten hebben alle drie het boek gelezen.*
the students have all three the book read

Romanian

(ii) a. *Toţi trei studenţi-i au citit carte-a.*
all three students the have read book the

b. *Studenţi-i au citit toţi trei carte-a.*
students the have read all three book the

The aim of this article is to show three things: that a ∀NumQ occupies the same position as a bare universal quantifier, namely, the head position of a Quantifier Phrase; that a ∀NumQ must be base-generated in Q° in its entirety and cannot be derived by moving a numeral from a position inside DP up to Q°; that the derivation or rather creation of a ∀NumQ can easily be understood if one combines aspects of the theory of word formation in Di Sciullo and Williams (1987) with the theory of the morphology of numerals in Booij (2008).

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1. Introduction

The phenomenon of floating quantifiers, illustrated in the following English and Italian sentences, has often been discussed in the literature:

English

(1) a. *All the students have read the book.*
b. *The students have all read the book.*

Italian

(2) a. *Tutti gli studenti hanno letto il libro.*
all the students have read the book
b. *Gli studenti hanno tutti letto il libro.*
the students have all read the book

This article is motivated by the fact that in the Germanic and Romance languages (among others) a universal quantifier can combine with a numeral and form a floating quantifier. The following examples from Dutch and Italian demonstrate this:

Dutch

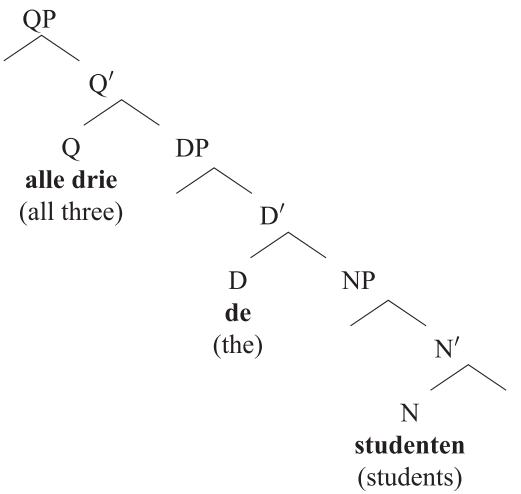
(3) a. *Alle drie de studenten hebben het boek gelezen.*
all three the students have the book read
b. *De studenten hebben alle drie het boek gelezen.*
the students have all three the book read

Italian

(4) a. *Tutti e tre gli studenti hanno letto il libro.*[1]
all and three the students have read the book
b. *Gli studenti hanno tutti e tre letto il libro.*
the students have all and three read the book

These data show that there are similarities between a bare universal quantifier, which I will call ∀Q, and a universal quantifier in combination with a numeral, which I will call a *universal numeric quantifier* or simply ∀NumQ. First of all, like a ∀Q, a ∀NumQ selects a definite DP. Secondly, both ∀Q and ∀NumQ can float. This very strongly suggests that ∀Q and ∀NumQ occupy the same position. Giusti (1990) and Shlonsky (1991) argue that a ∀Q occupies the head position of a Quantifier Phrase. If the same applies to a ∀NumQ, the following structure describes sentences such as the Dutch example in (3a):

(5)



Not all co-occurrences of a ∀Q and a numeral constitute a ∀NumQ, particularly if a determiner comes between the quantifier and the numeral. Note the way in which the following Dutch and Italian sentences contrast with their counterparts in (3) and (4):

Dutch

(6) a. *Al de drie studenten hebben het boek gelezen.*
all the three students have the book read
b. *De drie studenten hebben allen het boek gelezen.*[2]
the three students have all the book read

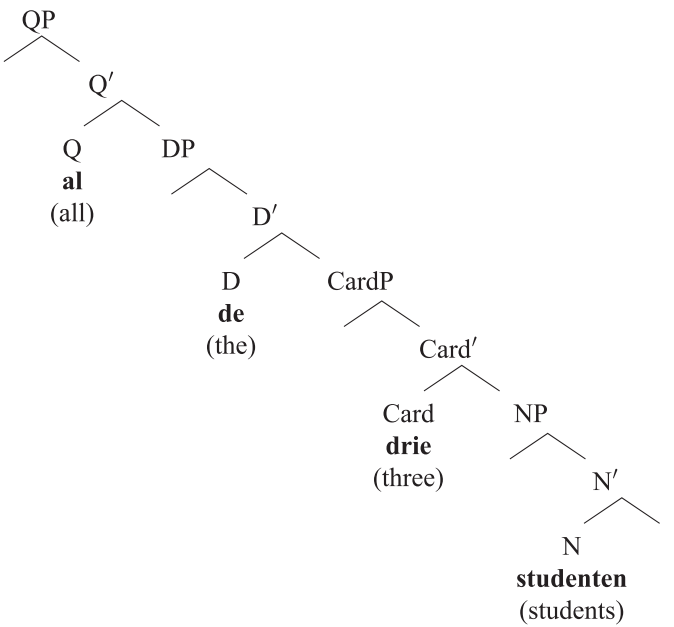
Italian

(7) a. *Tutti i tre studenti hanno letto il libro.*
all the three students have read the book
b. *I tre studenti hanno tutti letto il libro.*
the three students have all read the book

In these sentences the co-occurrence of a universal quantifier with a numeral does not constitute a ∀NumQ. Rather, it is an instance of a ∀Q that has selected a DP that contains a cardinal numeral. The structure of the nominal phrase in (6a) would thus be as in (8), in contrast to (5).

I use the term CardP rather than NumP in order to avoid confusion with the NumP in Ritter (1991), which refers mainly to singular vs. plural number. The term CardP is borrowed form Julien (2003), who also uses it for phrases headed by cardinal numbers. Treating cardinal numbers as phrasal heads is consistent with several other analyses in the literature. Longobardi (2001) and Delsing (1993), for example, treat numerals as items that can undergo head movement to D.

(8)



The questions that arise when one considers the phenomenon of ∀NumQ are as follows:

> How do two syntactic heads, a universal quantifier and numeral, come together to form a constituent? Does a Card move to Q to combine with the quantifier, or are the two elements base-generated together in the Q-position? If movement takes place, what is it that causes or motivates that movement? If the universal quantifier and the numeral are base-generated together in Q, how is this at all possible?

The purpose of this article is to address these questions. I will show that it is impossible to derive a ∀NumQ by moving the numeral to Q and that a ∀NumQ is in fact base-generated in its entirety in Q. I will also show that the derivation or rather creation of a ∀NumQ can easily be understood if one combines aspects of the theory of word formation in Di Sciullo and Williams (1987) with the theory of the morphology of numerals in Booij (2008). The remainder of this article is organized into five sections. In Section 2 I give a brief presentation of my underlying theoretical assumptions. In Section 3 I show that a ∀NumQ must be base-generated in its entirety in the Q-position. In Section 4 I discuss how a ∀NumQ is actually formed in the lexicon before it is inserted into Q. In Section 5 I present the obligatory annoying unresolved issues. Section 6 is a brief summary.

2. Theoretical foundations

As the reader has probably surmised, I follow the Stranding Analysis of floating quantifiers that originated with Sportiche (1988) and has been further refined in Giusti (1990) and Shlonsky (1991). A further refinement of the Stranding Analysis is presented in Cirillo (2009). I am of the opinion that the Stranding Analysis accounts for floating quantifiers better than the various so-called adverbial analyses put forth by authors including Baltin (1995), Doetjes (1997), Bobaljik (2003), Fitzpatrick (2006) and others. These analyses fail to account for the obvious relationship between the (a) and (b) sentences in (1) and (2) and they fail to take into account certain developments in linguistic theory that have taken place since the Stranding Analysis was first conceived. For example, all adverbial analyses claim that the Stranding Analysis falsely predicts the grammaticality of the following sentences:

(9) a. **The students have arrived all.*
b. **The prisoners were arrested all.*

This claim is false if one considers the Split VP Hypothesis, which began with Larson (1988) and has been further pursued in Sportiche (1990), Koopman and Sportiche (1991), Chomsky (2000), Grewendorf (2002), Adger (2003) and elsewhere. Under this widely accepted approach, verbs move from V to v if they are transitive or causative but remain in V if they are passive or unaccusative. Also, the base-position of agentive subjects is [SPEC, vP] rather than [SPEC, VP] and direct objects are base-generated in [SPEC, VP] rather than as complements of V. If one follows this approach the quantifiers in the sentences in (9) are below their base-position, which clearly explains why the sentences are ungrammatical. Another classic argument by proponents of the adverbial approach to floating quantifiers is the claim that there are instances in which a floating quantifier and its associated DP could not possibly form a constituent:

(10) a. *David, Stephen and Chan have all arrived.*
b. **All David, Stephen and Chan have arrived.*

In order to account for this discrepancy under the Stranding Analysis, one has to claim that the quantifier and the three proper nouns do in fact form a constituent, meaning that (10a) and (10b) are related, but that there is a Surface Structure constraint that would be formulated a follows:

(11) A plural quantifier cannot appear before a singular noun.

This constraint blocks (10b). Stranding circumvents the constraint, as in (10a). This ad hoc constraint is admittedly not an attractive solution. Under the adverbial approach one would simply say that the quantifier in (10a) is an adverbial, an adjunct to VP, and that (10b) is simply never generated. The problem is that under the adverbial approach one does not explain *why* (10b) is impossible. One would need to impose a selectional constraint on *all*. Furthermore, one would have to explain why the nominal version of *all* cannot occur with conjoined singular DPs, as shown in (10b), while the adverbial version can. Ultimately, an adverbial approach has as much difficulty with the sentences in (10) as the Stranding Analysis, and these sentences therefore do not provide sufficient reason for choosing an adverbial approach over the Stranding Analysis. Due to space limitations I will not provide additional reasons for following the Stranding Analysis.

As I mentioned in the Introduction, I assume that cardinal numbers are phrasal heads and that the hierarchy in (8) reflects the standard order in the nominal domain. If one considers languages in which possessive pronouns co-occur with articles, the hierarchy in (8) must be supplemented as follows:

(12) Q > D > Poss > Card > N

I will assume this hierarchy for the nominal domain based on the following Italian sentence:

(13)	*Tutti*	*i*	*suoi*	*tre*	*figli*	*stanno*	*dormendo*.
	all	the	her	three	children	are	sleeping

Note that a ∀NumQ generates word order that seems to contradict the hierarchy in (12), as the following Dutch example illustrates:

(14)	*Alle*	*drie*	*de*	*studenten*...
	all	three	the	students...
	Q	Card	D	N

However, if one considers the ∀NumQ to occupy Q, there is no violation of the hierarchy in (12).

There is one last item that I must mention while discussing my theoretical foundations because the reader will need to be aware of it in order to understand some of the Italian, Spanish and Romanian data that I will present. The following sentences illustrate a kind of verb movement that takes place in Italian:

(15)	a.	*Gli*	*studenti*	*hanno*	*tutti*	*mangiato*.
		the	students	have	all	eaten

b. *Gli studenti hanno mangiato tutti.*
the students have eaten all

This type of movement is discussed in Belletti (1990). It is sometimes but not always optional and can affect all types of non-finite verbal elements, including past participles, passive participles, infinitives and gerunds. It would be far beyond the scope of this article to present Belletti's theory here. It is sufficient that reader know that this type of movement takes place. I point out that it takes place not only in Italian but in other Romance languages as well, such as Spanish and Romanian, but not in French.

I have now provided enough theoretical background and am ready to demonstrate that a ∀NumQ cannot be derived by movement and must be base-generated in its entirety in Q.

3. Base-generation of ∀NumQ in Q

3.1. *Introduction*

In a combination such as *all three* the semantics of the two individual elements seems to be preserved, namely, universality and the quantity *three*. For this reason, in the interests of compositionality, one might prefer to derive a ∀NumQ by starting out with two independent elements, Q and Card, and then moving Card to Q. Nonetheless, in this section I will show that a movement analysis does not work and that Q and Card must be base-generated in the same position. In the next section I will show that there is another way to produce a ∀NumQ that is still consistent with compositionality. My arguments in this section, each of which is covered by a separate subsection, are based on structural obstacles to movement, on the lack of motivation for movement, on the incompatibility of the selectional properties of ∀NumQ and Card in Romanian, on the fact that floating adverbial quantifiers in Dutch and Swedish cannot be combined with a numeral, on the non-universality of ∀NumQ, on the fact that a ∀NumQ can co-occur with another numeral, and on the fact that ∀NumQ has been lexicalized to some extent in Romanian.

3.2. *Obstacles to movement*

In languages like Dutch, Italian and Romanian, the D-position is always occupied when there is a ∀NumQ, whether the ∀NumQ is stranded or

not. If D is always occupied, then Card cannot be moving from Card to Q, across D, to form a ∀NumQ. Card must originate in Q in the first place. The following pairs of sentences demonstrate this:

Dutch

(16) a. *Alle drie de studenten hebben het boek gelezen.*
all three the students have the book read
b. *De studenten hebben alle drie het boek gelezen.*
the students have all three the book read

Italian

(17) a. *Tutti e tre gli studenti hanno letto il libro.*
all and three the students have read the book
b. *Gli studenti hanno letto tutti e tre il libro*
the students have read all and three the book

Romanian

(18) a. *Toţi trei studenţi-i au citit carte-a.*
all three students the have read book th
b. *Studenţi-i au citit toţi trei carte-a.*
students the have read all three book the

3.3. *Lack of motivation for movement*

The purpose of movement is to satisfy features, either of the target or of the goal or of both. The fact that the following phrases are grammatical shows that there is nothing that forces a numeral to move into Q:

English

(19) a. *All the three students*

Italian

b. *Tutti i tre studenti…*
all the three students

One could of course say that no movement of the numeral takes place in these phrases because of an intervening head in D. The point is that if numerals or universal quantifiers bore a feature that required movement of the numeral to Q, the phrases in (19) would be unacceptable. Furthermore, even if there is no intervening head, a numeral does not move to Q. Being positioned in Q means strandability, and a numeral is not strandable:

(20) a. *All lions are dangerous.*
b. *Lions are all dangerous.*

(21) a. *Three lions are dangerous.*
b. **Lions are three dangerous.*

One might argue that there is evidence that a numeral is drawn to Q by a universal quantifier if there is nothing in D to block such movement, given phrases like *all three students*. This is not a plausible claim, however. The movement of Card to Q across an empty D position should produce a strandable ∀NumQ, but stranding is not possible in English if D is empty:

(22) a. *All three students have read the book.*
b. **Students have all three read the book.*

In other words, the numeral cannot be moving across an empty D position to form a ∀NumQ in (22a), and there must be another explanation for the missing definite article. In Section 5 there will be more on ∀NumQs that appear without a determiner in English.

To summarize this subsection, (19) shows that there are no features forcing movement of Card to Q; (20) and (21) show that numerals do not occupy Q on their own, which indicates that they do not move there; and (22) shows that movement of Card to Q would not in and of itself create a strandable ∀NumQ.

3.4. *Selectional properties of ∀NumQ in Romanian*

As already shown in example (18), Romanian possesses a strandable ∀NumQ. Careful analysis of the Romanian ∀NumQ reveals that it cannot have been derived by movement of the numeral to Q. Before presenting the data, I will point out some important peculiarities of the Romanian language.[3]

Romanian places both the definite article and possessive pronouns after the noun, and the two can co-occur. In fact, possessive pronouns in Romanian require the support of a determiner, just as in Italian. The following sentence illustrates this:

(23) *Copii-i* *tăi* *au* *venit* *acasă.*
children the yours have come home

Romanian also has the prenominal determiners *cel* (masculine) and *cea* (feminine). The plurals of *cel* and *cea* are *cei* and *cele*, respectively. The universal quantifier *toţi* (feminine *toate*) selects a definite DP, as one would expect, however that DP must be headed by the post-nominal definite article. It cannot be headed by the prenominal determiners *cei* and *cele*:

(24) a. *Toate cărţi-le sunt interesante.*
all books the are interesting
b. **Toate cele cărţi sunt interesante.*
all the books are interesting

There are two exceptions to this rule. The universal quantifier can select a DP headed by a prenominal determiner if that determiner is a demonstrative or if a numeral is present:

(25) a. *Toate acele cărţi sunt interesante.*
all those books are interesting
b. *Toate cele trei cărţi sunt interesante.*
all the three books are interesting

Whether a universal quantifier selects a DP headed by a post-nominal definite article, as in (24a), or a DP headed by a prenominal determiner, as in (25a) and (25b), it can be stranded. The following sentences are (24a), (25a) and (25b) with stranding:

(26) a. *Cărţi-le sunt toate interesante.*
books the are all interesting
b. *Acele cărţi sunt toate interesante.*
those books are all interesting
c. *Cele trei cărţi sunt toate interesante.*
the three books are all interesting

When a numeral is used in a definite DP such as the Romanian equivalent of *the three books*, the D-element must be a form of *cel* or some other prenominal determiner, such as a demonstrative. It cannot be the post-nominal definite article:

(27) a. *Cele/Acele trei cărţi sunt interesante.*
the/those three books are interesting
b. **Trei cărţi-le sunt interesante.*
three books the are interesting

In other words, CardP can only be selected by a prenominal determiner.

With that background information we can now look at ∀NumQ in Romanian. The Romanian ∀NumQ can be formed with numerals up to ten. Like a bare universal quantifier, it selects a DP headed by the post-nominal definite article or by a prenominal demonstrative. However, again like a bare universal quantifier, it cannot select a DP headed by a form of the prenominal determiner *cel*:

(28) a. *Toate trei cărţi-le sunt interesante.*
all three books the are interesting

b. *Toate trei acele cărţi sunt interesante.*
all three those books are interesting
c. **Toate trei cele cărţi sunt interesante.*
all three the books are interesting

The following examples, derived from the sentences in (28a) and (28b), show that a Romanian ∀NumQ is strandable:

(29) a. *Cărţi-le sunt toate trei interesante.*
books the are all three interesting
b. *Acele cărţi sunt toate trei interesante*
those books are all three interesting

With that background, I can easily explain why a ∀NumQ in Romanian cannot be formed by moving the numeral to Q. The derivation of a ∀NumQ by movement of the numeral would have to go through the following steps:

We would start with a CardP such as *trei cărţi* ('three books'). This CardP would have to be selected by a prenominal determiner such as *cele* ('the'), forming the DP *cele trei cărţi* 'the three books'. This DP would then be selected by the universal quantifier *toate* 'all', forming the QP *toate cele trei cărţi* 'all the three books':

(30) *Toate cele trei cărţi sunt interesante.*
all the three books are interesting

At this point the quantifier and the numeral are not contiguous and do not yet form a ∀NumQ. This can be seen in (31), which is (30) after it has undergone stranding. The fact that the quantifier is stranded without the numeral shows that the quantifier and the numeral in (30) do not form a ∀NumQ:

(31) *Cele trei cărţi sunt toate interesante.*
the three books are all interesting

Suppose now that we wanted to move the numeral in (30) to Q in order to form a ∀NumQ. Let's ignore the problem of the intervening head in D. If we moved the numeral to Q in (30) we would generate the ungrammatical sentence in (28c). The only way to rescue (28c) would be to change the prenominal determiner to a post-nominal one:

(32) *Toate trei cărţi-le sunt interesante.*
all three books the are interesting

In other words, in order to make a movement analysis work we would have to retroactively alter selections already made. Because the selectional

requirements of a ∀NumQ are incompatible with those of Card, the only way to get a universal quantifier and a numeral together in Romanian is to base-generate them together in Q.

3.5. *Dutch and Swedish adverbial quantifiers*

As shown in (33), when the Dutch universal quantifier *al* is stranded, it can take on its stranded form *allen* or become the adverbial *allemaal*:

(33) a. *Al de studenten hebben het boek gelezen.*
all the students have the book read
b. *De studenten hebben allen/allemaal het boek gelezen.*
the students have all the book read

However, when the ∀NumQ *alle drie* (*all three*) is stranded, the quantifier *alle* cannot be replaced with *allen* or *allemaal* the way it could if it were by itself:

(34) a. *Alle drie de studenten hebben het boek gelezen.*
all three the students have the book read
b. **De studenten hebben allen drie/allemaal drie het boek gelezen.*
the students have all three the book read
c. *De studenten hebben alle drie het boek gelezen.*
the students have all three the book read

This shows that the ∀NumQ does not consist of the independent elements *alle* and *drie* but is an indivisible unit. If the two elements did not form a unit, one would expect (34b) to be as acceptable as (34c). That is, one would expect *alle* to become *allemaal* when stranded regardless of the presence of the numeral. Something similar occurs in Swedish, in which the quantifier *alla* often assumes the adverbial form *allihop* when stranded:

(35) a. *Alla studenterna kan ha läst boken.*
all students the might have read book the
b. *Studenterna kan allihop ha läst boken.*
students the might all have read book the

However, when the ∀NumQ *alla tre*, meaning *all three*, is stranded, the numeral *tre* cannot appear with the adverbial quantifier *allihop*:

(36) a. *Studenterna kan alla tre ha läst boken.*
students the might all three have read book the

b. **Studenterna kan allihop tre ha läst boken.*
students the might all three have read book the

Once again, if *alla tre* were not an indivisible unit, one would expect it to be able to become *allihop tre* in stranded form.

3.6. *Lack of universal numeric quantifier in certain Romance languages*

I will argue in Section 4 that a ∀NumQ is formed by a non-universal, language-specific, lexically stored rule and inserted into Q. Assuming for the moment that this is so, not all languages can be expected to have a ∀NumQ. This expectation is met. The Romance languages that we have looked at, Italian and Romanian, seem to have a ∀NumQ. However, there are also Romance languages that appear not to have a ∀NumQ, including Spanish, Catalán, Portuguese and French. This will be demonstrated in the Spanish sentences in (37) to (39). I point out that one could take these sentences and replace each Spanish word with its French, Portuguese or Catalán equivalent and obtain exactly the same results. Let's take a look at these sentences now in order to see why I claim that some languages, like Spanish, do not have a true ∀NumQ:

(37) a. *Todos los tres libros son interesantes.*
all the three books are interesting
b. *Los tres libros son todos interesantes.*
the three books are all interesting
c. **Todos tres los libros son interesantes.*
all three the books are interesting
d. **Todos tres libros son interesantes.*
all three books are interesting
e. **Los libros son todos tres interesantes.*
the books are all three interesting

The (a) sentence corresponds to the normal Q > D > Card > N hierarchy. It is an instance of a Q that selects a DP that includes a CardP. The (b) sentence is simply the (a) sentence with stranding of the universal quantifier. The (c) sentence shows that the combination Q plus Card cannot select a DP as it can in Dutch or Italian, which is already an indication that Spanish has no ∀NumQ. The (d) sentence shows that the combination Q plus Card cannot select a bare NP as it seems to do in English. The (e) sentence shows that a version of (c) and (d) with quantifier stranding also does not exist. Observe now the following sentences, which show that while Spanish does not have a true ∀NumQ it does have a substitute:

(38) *Los libros son todos los tres interesantes.*
the books are all the three interesting

This sentence suggests that Spanish might have something like a stranded ∀NumQ, but there are at least two indications that this is not the case. The presence of the definite article between Q and Card is the first indication that this is not a ∀NumQ. The second indication is the double-occurrence of the definite article. What I would suggest is that the phrase *todos los tres* is a kind of appositive QP similar to expressions such as the appositive DP *ellos mismos* 'themselves'. This is shown in the following sentence, in which the appositive *ellos mismos* appears in the same position as *todos los tres* in (38):

(39) *Los tres libros son ellos mismos interesantes.*
the three books are themselves interesting

Alternatively, one might be inclined to say that (38) is an instance of a true ∀NumQ that has been stranded and that the double occurrence of the definite article is simply a case of multiple spell-out. The following sentences show that this analysis is impossible:

(40) a. *Todos tus tres niños han venido a casa*
all your three children have come home
b. *Tus tres niños han venido todos a casa.*
your three children have come all home
c. *Tus niños han venido todos los tres a casa*
your children have come all the three home
d. **Tus niños han venido todos tus tres a casa.*
your children have come all your three home

The (a) sentence contains a universal quantifier (*todos*) that has selected a DP in which the possessive pronoun *tus* 'your' has moved to D. The (b) sentence is simply the (a) sentence with quantifier stranding. In the (c) sentence, we see that the appositive phrase *todos los tres* appears in what looks like a stranding position. If this were a case of ∀NumQ stranding with multiple spell-out of the item occupying D, we would not see the definite article *los* in the stranded phrase, but the possessive pronoun *tus*. As the (d) sentence shows, multiple spell-out of the possessive produces ungrammaticality.

One might ask how we can be sure that the stranded ∀NumQ observed in languages like Italian, Romanian and Dutch is not an appositive QP like the one found in French and Spanish. There is probably nothing to prevent one from analyzing stranded ∀NumQs as appositive QPs, but there are three reasons why I believe that such an analysis would be

wrong. First of all, a major generalization would be missed because the following two Dutch sentences would have to be accounted for separately while the Stranding Analysis derives both sentences from a common base-structure:

(41) a. *Alle drie de studenten hebben het boek gelezen.*
all three the students have the book read
b. *De studenten hebben alle drie het boek gelezen.*
the students have all three the book read

Secondly, there is a clear structural difference between the ∀NumQ found in Dutch, Italian and Romanian, in which there is no determiner between the quantifier and the numeral, and the appositive QP found in Spanish, French and other languages, in which there is always a determiner between Q and Card.

Thirdly, unlike a true ∀NumQ, the appositive QP only occurs post-verbally, suggesting that a ∀NumQ and an appositive QP are not the same:

(42) a. *Los alumnos han leído todos los tres el libro.*
the students have read all the three the book
b. **Todos los tres los alumnos han leído el libro.*
all the three the students have read the book

For these reasons, I choose to analyze the ∀NumQ found in languages like Dutch, Italian and Romanian as being different from the appositive QP found in languages like Spanish and French.

Let's summarize what we can conclude from this discussion of Spanish, which is also valid for Catalán, Portuguese and French. We have seen that Spanish, unlike Italian and Romanian, does not have a true ∀NumQ but that it has a type of appositive QP that functions like a stranded ∀NumQ. The fact that not all the languages in the rather tightly knit Romance language family possess a true ∀NumQ strongly suggests that a ∀NumQ is formed by a lexically stored rule and inserted directly into Q. In other words, a ∀NumQ is not derived by merging a quantifier and a numeral but is base-generated as a unit.

3.7. *Co-occurrence of ∀NumQ and numeral*

I have been assuming the following hierarchy in the nominal domain:

(43) Q > D > Card >N

If a ∀NumQ is base-generated in Q, the model predicts that a ∀NumQ will be able to co-occur with a bare numeral in Card. Observe the following Dutch and Italian sentences:

(44) a. ?*Alle drie de drie studenten hebben het boek gelezen.*
all three the three students have the book read
b. *De drie studenten hebben alle drie het boek gelezen.*
the three students have all three the book read

(45) a. ?*Tutti e tre i tre studenti hanno letto il libro.*
all and three the three students have read the book
b. *I tre studenti hanno letto tutti e tre il libro.*
the three students have read all and three the book

The immediate relevance of (44) and (45) is that they contain two numerals. This can only be possible if one of the numerals is in Card and the other in Q with the universal quantifier. This may be the strongest indication yet that the quantifier and numeral in a ∀NumQ are base-generated together in Q.

3.8. *Romanian again: Lexicalized universal numeric quantifiers*

Assuming that a ∀NumQ is base-generated in Q by a lexically stored rule, one might ask whether lexicalization of the actual ∀NumQ might also occur. There is evidence in Romanian that it does happen. In certain forms of regional, colloquial, or perhaps antiquated speech, the universal quantifier *toţi* has combined with the numerals from three to ten to form a single word with the syntax (strandability) and the semantics of a normal ∀NumQ. There are three things that tell us that these lexicalized quantifiers are a single word. First of all, the quantifier *toţi* appears in the reduced form *tus* and is almost like a prefix with low stress. Secondly, these lexicalized ∀NumQs, which always begin with *tus*, can be masculine or feminine even though *tus* is actually the reduced form of the masculine form *toţi*. Thirdly, this is not a truly productive process, since it only covers numerals from three to ten. The words are as follows:

(46) a. *tustrei* 'all three'
b. *tuspatru* 'all four'
c. *tuscinci* 'all five'
d. *tusşase* 'all six'
e. *tusşapte* 'all seven'
f. *tusopt* 'all eight'
g. *tusnouă* 'all nine'
h. *tuszece* 'all ten'

As I have mentioned, I will argue in the next section that a ∀NumQ is not a lexically stored item per se but is formed by a lexically stored rule that combines two lexical entries. My conjecture is that because a ∀NumQ is formed by a lexically stored rule and inserted from the lexicon into Q, it lends itself to lexicalization. The examples in (46) support this.

3.9. *Summary*

In this section I have presented a considerable amount of evidence that a ∀NumQ is not derived by moving Card to Q but is base-generated in its entirety in Q. First of all, the determiner between Q and Card is an obstacle to movement of the numeral and there is a lack of motivation for such movement anyway. In Romanian, a CardP can only be selected by a pre-nominal determiner, but a ∀NumQ can only select a DP headed by a post-nominal determiner. These incompatible selectional properties of Card and ∀NumQ mean that the only way to combine Q and Card is to base-generate them together. In Dutch and Swedish the universal quantifier can assume adverbial form when stranded, but not in combination with a numeral. This inalterability of the universal quantifier in a ∀NumQ is an indication that a ∀NumQ is not derived by moving two separate items together but is base-generated as a unit in Q. Not all languages have a ∀NumQ, which also suggests that it is a phenomenon governed by lexical rules that insert it into Q rather than by syntactic movement rules. A ∀NumQ can also co-occur, albeit with very marginal results, with a numeral, which shows very clearly that a ∀NumQ is base-generated in Q. Finally, Romanian has experienced a certain lexicalization of ∀NumQ, which also suggests that a ∀NumQ is formed by lexical rules rather than by movement. The facts are simple. Because a numeral can be stranded with a universal quantifier, it must be located in Q, and if it cannot be moved there, it must have been base-generated there. In the following section, I will go into more detail about how a ∀NumQ is actually formed and what kind of syntactic category it is.

4. Formation and categorization of *all three*

I have argued that an expression such as *all three* is located in Q, the head position of QP, but this raises two questions: How do the two elements *all* and *three* come together in the first place and what kind of syntactic category does this word combination represent? The purpose of this section is to answer these questions.

Di Sciullo and Williams (1987) refer to anything that can be inserted into an X° position as a *syntactic atom*. A syntactic atom can consist of more than one word, in which case it is either a *phrase* or a *compound*. I will briefly explain how Di Sciullo and Williams distinguish between these two items.

A phrasal syntactic atom is simply a phrase that has been reanalyzed as a word. Accordingly, it is referred to by Di Sciullo and Williams as a *syntactic word*. The Romance languages are full of nouns that are actually reanalyzed VPs. An example is the French noun *essuie-glace* 'windshield wiper', which is a VP consisting of the finite verb *essuie* 'wipes' and the object noun *glace* 'windshield'. The French noun *lève-tôt*, also a reanalyzed VP, is an even better example because it is a noun even though it does not contain a nominal element. It consists of the finite verb *lève* 'gets up' and the adverb *tôt* 'early' and means *early riser*. An important characteristic of syntactic words in Di Sciullo and Williams' analysis is their syntactic atomicity or impenetrability. In an expression such as *essuie-glace*, for example, it is impossible to insert an adverb between the verb and the noun, although this would be completely unproblematic in a normal VP:

(47) **essuie-bien-glace*
wipes well windshield

Di Sciullo and Williams argue that expressions like this cannot be considered to be compounds in the usual sense, because a compound has an easily identifiable head that clearly determines its syntactic category. For example, in the English compound *bartend* the head is the verb *tend*. Furthermore, the head of a compound determines not only its syntactic category but its semantics as well, so that in the compound *dogsled*, for example, the head is *sled* and the meaning is a *sled pulled by dogs* rather than a *dog that pulls a sled*. Note also that compounds are head final, unlike the above-mentioned reanalyzed VPs *essuie-glace* and *lève-tôt*. This leads Di Sciullo and Williams to treat compounds as affixed words rather than as phrases. Di Sciullo and Williams claim that both syntactic words and compounds are idiomatic and therefore listed in the lexicon.

Before applying Di Sciullo and Williams' approach to the question of ∀NumQ, there are two more characteristics of compounds that I would like to point out. First of all, in a compound the individual elements often lose their compositionality. Think of expressions like *babysitter* and *bodyguard*. Secondly, in English, primary stress normally falls on the first element in the compound. With that background, I would like to consider whether a ∀NumQ could be classified as a compound or a syntactic word.

A ∀NumQ does not seem to fit the description of a compound at all. For example, a phrase like *all three* could not be said to be a single lexical item consisting of two words, since it is compositional, with both elements retaining their full meaning. Furthermore, it would be difficult to say that *all three* is a lexically stored item. The universal quantifier can combine with an infinite number of numerals. It is just as natural to say "all seventeen million, three hundred thousand, five hundred thirty-six inhabitants" as it is to say "all three inhabitants." Another problem with classifying a ∀NumQ as a compound is the fact that in *all three* stress is on the numeral. Normally, one would expect the stress to fall on the first element if this were a normal compound. Another relevant point is that if *all three* were a compound, since compounds are head-final, the numeral would have to be the head. However, it would be difficult to argue that a ∀NumQ is a numeral rather than a universal quantifier. A ∀NumQ like *all three* behaves like a universal quantifier, not like a numeral. It can be stranded, while a numeral cannot, and it shows the semantic strength of a universal quantifier, not the weakness of a numeral:

(48) a. *There are three rabbits in the garden.*
b. **There are all three rabbits in the garden.*

A ∀NumQ can also be negated in a non-contrastive context, while a numeral cannot:

(49) a. *Not all three students did their homework.*
b. **Not three students did their homework.*

It is for these reasons that I refer to phrases like *all three* as a universal numeric quantifier or ∀NumQ rather than a compound quantifier.

Even if a ∀NumQ is not a compound, it is nonetheless a combination of two lexical items that together occupy an X° position. The two lexical items also form an impenetrable unit, since nothing can appear between the universal quantifier and the numeral. For these reasons, Di Sciullo and Williams' term *syntactic word* seems more appropriate than the term *compound* if one is speaking about a ∀NumQ. The problem is that according to Di Sciullo and Williams a syntactic word is an idiomatic, stored lexical item, and because there are an infinite number of combinations of a universal quantifier and a numeral it would be difficult to say that a ∀NumQ is a stored item.

What is stored in the lexicon, I propose, is a *rule* that allows the universal quantifier to combine with a numeral. Lexical rules for the combination of numerals are known to exist. In Booij (2008), for example, the Dutch numerals from *one* to *nineteen* are argued to be stored lexical

words, as are the multiples of ten (*twenty*, *thirty*, *forty* etc.) and higher numbers like *hundred* and *thousand*. Other numerals, such as *twenty-three* or *four hundred eight*, are formed by lexical rules that are comparable to the syntactic rules that combine words and phrases. Booij refers to the rules that form numbers as *constructional idioms*. They operate on a finite number of numerals (words) to form an infinite number of numbers, just as syntactic rules can form an infinite number of sentences. Booij is concerned with Dutch numerals but, as he points out, his concept of constructional idiom carries over to other languages.

The fact that number formation rules are lexical idioms creates the expectation that there would be cross-linguistic variation. There are in fact numerous examples of inter- and intra-linguistic variation. In modern English one says *twenty-three* rather than *three and twenty*, however *three and twenty* was the norm until fairly recent times, and is still the norm in all other Germanic languages. In older varieties of Italian it was also normal to say *twenty and three* (*venti e tre*). In modern Italian the conjunction is omitted and one says *ventitre*. Standard French has no word for *seventy*, *eighty* or *ninety*. *Seventy* is expressed by saying *sixty-ten* (*soixante-dix*), *eighty* is *four-twenty* (*quatre-vingt*), and *ninety* is *four-twenty-ten* (*quatre-vingt-dix*). Mandarin has a one-syllable word (*wàn*) which means *ten thousand* but has no word meaning *million*. The number *one million* is thus expressed by saying *one hundred ten thousand* (*yìbǎi-wàn*). This goes to show that number-formation is handled by language-specific lexical rules.

The rule that I propose for the formation of ∀NumQ follows from Booij's rules for number formation and may very well be one of them, since it also involves numerals. It is analogous to the rule that allows two numbers such as *twenty* and *three* to appear as the single word *twenty-three* in the Card-position. The ∀NumQ formation rule must be a lexical rule, for at least two reasons. First of all, the∀NumQ that it creates is inserted directly into Q, an X° position. Secondly, like the rules for number formation, it is subject to cross-linguistic variation. Dutch and Romanian form a ∀NumQ by simply combining a universal quantifier and numeral. Italian requires the insertion of a conjunction between the two elements. French and Spanish do not have a rule that creates ∀NumQ. Incidentally, as argued in Menger (1892), the insertion of a conjunction in an Italian ∀NumQ is believed to have arisen as a generalization from the above-mentioned (now defunct) conjunction-insertion rule for number formation. The fact that the rule for ∀NumQ formation is a generalization from a number formation rule suggests that the ∀NumQ formation rule is itself part of the group of number formation rules described by Booij. The fact that in Romanian a ∀NumQ can only be

formed with the numerals from one to ten is also a strong indication that a language-specific lexical rule is involved in ∀NumQ formation.

In this section I have argued that a ∀NumQ can be explained as a syntactic word within the framework of Di Sciullo and Williams (1987) that has been created by means of a ∀NumQ formation rule that is actually one of the constructional idioms that create numbers in the manner described by Booij (2008). My analysis provides an explanation for how the Q-position can be occupied by two elements, and with this explanation the behavior of a ∀NumQ follows nicely from the Stranding Analysis of floating quantifiers. As is the case with most theories, there is an issue with the present one. It will be discussed in the following section.

5. Unresolved question: what happens to the definite article in English?

5.1. *Introduction*

I have posited the following base-structure for phrases involving a ∀NumQ:

(50) ∀NumQ > D > N

Examples (3), (4) and (18), repeated here as (51) to (53), illustrate the cross-linguistic validity of this structure. The (b) sentences in the following examples correspond to the (a) sentences with stranding of the ∀NumQ:

Dutch

(51) a. *Alle drie de studenten hebben het boek gelezen.*
all three the students have the book read
b. *De studenten hebben alle drie het boek gelezen.*
the students have all three the book read

Italian

(52) a. *Tutti e tre gli studenti hanno letto il libro.*
all and three the students have read the book
b. *Gli studenti hanno letto tutti e tre il libro.*
the students have read all and three the book

Romanian

(53) a. *Toţi trei studenţii au citit cartea.*
all three students-the have read book-the
b. *Studenţii au citit toţi trei cartea.*
students-the have read all three book-the

These sentences show that within the framework of the Stranding Analysis the base-structure in (50) works fine for Dutch, Italian and Romanian. Nonetheless, it raises some serious questions regarding the definite article in English. Consider the following four sentences:

(54) a. **All three the students have read the book*.
b. *The students have all three read the book.*
c. *All three students have read the book*.
d. **Students have all three read the book*.

In (54a) the underlying structure in (50) appears in the Surface Structure and produces infelicitous results that we do not see in the other languages that we have analyzed. Note that the word order in (50) is effectively Q > Card > D > N. This Surface Structure word order contrasts with the standard nominal hierarchy that I proposed above in (8) and (12), which was as follows:

(55) Q > D > Card > N.

I have demonstrated the cross-linguistic validity of this hierarchy with phrases such as the following:

(56) a. English: *All the three books*
b. Dutch: *Al de drie boeken*
c. Romanian: *Toate cele trei cărţi*
d. Italian: *Tutti i tre libri*

I would like to suggest that the formation of a ∀NumQ, which produces Q > Card > D word order, conflicts with the standard Q > D > Card hierarchy shown in (55) and (56) and may result in a language-specific Surface Structure constraint that blocks word order that deviates from the standard hierarchy. This constraint could be formulated as follows:

(57) Nominal elements that appear contiguously cannot deviate from the standard hierarchical order of Q > D > Card > N.

Stranding the ∀NumQ avoids the contiguous appearance of Q, Card and D and "rescues" a sentence just as the stranding operation in (54b) rescues (54a). This constraint would be similar to the Surface Structure constraint in (11) in Section 1 that would be needed to explain the following two sentences under the Stranding Analysis:

(58) a. *David, Stephen and Chan have all arrived.*
b. **All David, Stephen and Chan have arrived.*

If there is an English-specific Surface Structure constraint like (57), perhaps stranding is not the only way to evade it. Example (54c) shows that suppression of the article may be another strategy. If this is so, (54d) shows that both strategies, that is, stranding of the ∀NumQ and suppression of the article, cannot be applied at once. Clearly, this issue of the definite article illustrated in (54) is complicated and requires investigation. In the following subsections I will discuss different ways one might approach this problem.

5.2. *Solution 1: English has no ∀NumQ*

Suppose that English was more like Spanish and French and had no ∀NumQ. This would mean that in (54c) a universal quantifier has selected a DP in which the numeral has moved to an empty D-position. This approach would not only properly generate (54c). It would also explain the ungrammaticality of (54d), since in (54d) a numeral that is not located in Q has been stranded. Furthermore, it would correctly fail to produce the ungrammatical (54a). Nonetheless, this approach has at least three weaknesses. First of all, in the Germanic languages a bare universal quantifier like *all* normally must select either a DP headed by a definite determiner or a bare NP with a generic meaning:

(59) a. *All the students have read this book.*
b. *All students drink beer.*

The phrase *three students* in (54c) is neither a definite DP nor a bare NP with a generic meaning, and therefore should not be able to be selected by a bare universal quantifier.

The second problem with this solution is that it could only generate (54b) by positing an appositive QP such as the one found in Spanish. This is perhaps not a problem in and of itself, but keep in mind that in English, as shown in (54b) and (54c), the universal quantifier and the numeral appear in contiguous positions, with no determiner between them, in both stranding and non-stranding positions, just as in Dutch, Romanian and Italian. It therefore seems that English, too, has a true ∀NumQ. The situation is different in Spanish, Portuguese, French and Catalán, in which there is always a determiner between the quantifier and the numeral. Thus it would seem very unnatural to say that English has no ∀NumQ just because of the contrast between (54a) and (54c).

The third problem with this solution is that it wrongly generates the following sentence:

(60) ?/**Three students have all read the book.*

This sentence seems anomalous because if there is a universal quantifier present one expects a definite or generic DP. This already casts doubt on the idea just suggested that in (54c) a bare universal quantifier has selected a DP in which a numeral, which is not inherently definite, has moved to D. Nonetheless, for the sake of argument, let's assume for the moment that (60) is not totally bad and that it can be acceptable if one imagines that the numeral *three* refers to three specific students. In order to block (54d) we would then have to claim that the appositive QP *all three* cannot be co-referenced with a DP that is not overtly definite (accompanied by a definite article). This seems like a lot of trouble to go through to rescue a questionable sentence like (60).

5.3. *Solution 2: ∀NumQ selects a bare NP with no generic meaning*

We could say that English does possess a ∀NumQ and that (54a) is blocked by a Surface Structure constraint like the one in (57). Then, in order to generate (54c), we could say that an English ∀NumQ differs from a bare universal quantifier in that it can select a bare NP even if the NP has no generic meaning. There are two problems with this approach. The first problem is that we would be saying that a bare quantifier and a ∀NumQ, although they are both strandable universal quantifiers in Q, have different selectional properties. The only way around this would be to propose the rather ad hoc hypothesis that a bare universal quantifier and a ∀NumQ both select bare NPs but that when a ∀NumQ selects a bare NP, as in (54c), the generic meaning is blocked by the presence of the numeral. The second problem with this solution is that if we claim that a ∀NumQ can select a bare NP, we predict the grammaticality of (54d). To block (54d) we would be forced to propose another ad hoc constraint, namely, that a ∀NumQ can only be stranded if there is an overt definite article present, as in (54b). This approach is also unattractive.

5.4. *Solution 3: failure to spell out the definite article*

Another explanation for the contrasts in the examples in (54), hinted at in Section 5.1, might be as follows:

As shown in (54a), there is a language-specific constraint against producing word order that violates the standard hierarchical order Q > D > Card > N. This constraint can be complied with either by stranding, as in (54b), or by suppression of the definite article, as in (54c). The sen-

tence in (54d) would be blocked because it unnecessarily applies both strategies at once. This approach thus accounts for all the sentences in (54). Note that this suppression of the determiner also takes place in German:

(61) a. **Alle drei die Studenten haben das Buch gelesen.*
all three the students have the book read
b. *Alle drei Studenten haben das Buch gelesen.*
all three students have the book read

The problem with this solution is that deletion is something that one finds in phonology. Nonetheless, syntactic deletion does exist. Examples are ellipsis, the deletion of a lower copy of a moved constituent, and the deletion of the Afrikaans negation marker *nie* in certain instances when it occurs more than once in a clause.[4] Deletion of the definite article following a ∀NumQ is not unmotivated. The definiteness of the universal quantifier could be said to render the definite article redundant. Since numerals have the ability to function as determiners, the combination of a universal quantifier and a numeral renders the definite article even more redundant. If one simply allows for the deletion of the definite article following a ∀NumQ, one can easily explain the sentences in (54). I therefore conclude that this explanation for the missing definite article in (54c), although far from perfect, is preferable to the two solutions presented in Sections 5.2 and 5.3.

Some readers will no doubt be thinking that the English examples in (54) are evidence against the Stranding Analysis. My first comment would be that of the languages that we have looked at, only English and German pose a major challenge. My second comment is that an adverbial analysis would have at least as difficult a time with (54) as the Stranding Analysis. A proponent of the adverbial approach would say that the phrase *all three* in (54b) is some kind of adverbial or adjunct to vP. However, an adverbialist would also be faced with difficult questions: What is the phrase *all three* in (54c), what are its selectional properties, and why is there no definite article?

Some readers may also be thinking that if one is going to allow the deletion of a syntactic element, one could claim that the appositive QP that I posited for languages like Spanish in Section 3.6 is not an appositive QP at all but a ∀NumQ that creates a Surface Structure violation of the Q > D > Card order and leads to suppression of the definite article. This argument would proceed as follows:

In Spanish there is a lexical constructional idiom à la Booij (2008) according to which a ∀NumQ is formed by combining ∀, D and Card. This produces a syntactic word à la Di Sciullo and Williams that is inserted

into Q and selects a definite DP. This merging with a definite DP creates a Surface Structure violation of the Q > D > Card hierarchy in (55):

(62) *[$_{QP}$ *Todos los tres* [$_{DP}$ *los alumnos*]] *han leído el libro*
all the three the students have read the book

In this sentence a definite article follows a numeral, producing a violation of the standard hierarchy. The constraint against a Surface Structure violation of this hierarchy could be evaded either by stranding, as in (63a), or by deleting the determiner, as in (63b):

(63) a. *Los alumnos han leído todos los tres el libro.*
the students have read all the three the book
b. *Todos los tres ~~los~~ alumnos han leído el libro.*
all the three the students have read the book

This analysis would not work because it would not be able to account for what happens when the appositive QP found in Spanish and French co-occurs with a possessive pronoun instead of a definite article. Observe the following sentences, which are the same as in (63) except with a possessive pronoun:

(64) a. *Tus alumnos han leído todos los tres el libro.*
your students have read all the three the book
b. *Todos los tres ~~tus~~ alumnos han leído el libro.*
all the three your students have read the book

The problem here is that the appositive QP always contains the definite article, even if the subject DP contains a possessive pronoun. The (a) and (b) examples are thus impossible to link and deletion is not an option. The possessive pronoun is not redundant. The expression *todos los tres* can only be an appositive, not a strandable ∀NumQ.

5.5. *Section summary*

In this section we have looked at a problem associated with the suppression of the definite article in combination with a ∀NumQ in English and German. Three possible solutions were examined. The solution whereby there is a Surface Structure constraint that can be circumvented either by stranding or by suppression of the definite article seems to be the least problematic of the three solutions. This issue is a Germanic one, since in the Romance languages universal quantifiers do not select bare NPs. More language phyla would have to be investigated in order to see what issues there are with ∀NumQs, definite articles and bare NPs.

6. Overall summary

In this article I have postulated the existence of a ∀NumQ consisting of a universal quantifier and a numeral. I have presented several different types of evidence that show that a ∀NumQ cannot be derived by movement of the numeral to Q and is thus base-generated in Q in its entirety. A ∀NumQ is not exactly a listed item but it is generated by a rule that is stored in the lexicon and consequently has certain characteristics of a stored item. The rule that governs the creation of a ∀NumQ is comparable to the lexical rules for number formation posited in Booij (2008) and in fact is probably one of them. The fact that a ∀NumQ is created by a lexical rule makes it very comparable to Di Sciullo and Williams' *syntactic word*, which is inserted into a head position in the syntax just as I am saying that a ∀NumQ is inserted into Q. Since a ∀NumQ is formed by a rule stored in the lexicon, one would not expect it to be a universal phenomenon. Dutch, Italian and Romanian and probably English and German have a true ∀NumQ that selects a definite DP and can be stranded. Spanish, French, Portuguese and Catalán have no such element.

I have claimed that my ∀NumQ hypothesis in combination with the Stranding Analysis of floating quantifiers can account for the behavior of universal quantifiers in combination with numerals cross-linguistically. I believe that the data support this claim. There is an issue in the fact that the base-structure of a ∀NumQ surfaces in Italian, Romanian and Dutch but is only possible in English and German if the ∀NumQ is stranded or if the definite article is suppressed. I suggested that this might be due to a Surface Structure constraint that blocks deviation from the standard order of constituents in the underlying hierarchy of the nominal domain, but that further research in additional language phyla is necessary.

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Notes

1. The insertion of the conjunction *e* 'and' between the quantifier and the numeral in Italian seems a bit mysterious but it can be traced back several centuries. It is apparently from the Latin *et* 'and' and seems to have arisen as a generalization from conjunction insertion in numerals such as *venti e tre* 'twenty and three', which has become *ventitre* 'twenty-three' in modern Italian. For a discussion see Menger (1892). Correspondence address: Theoretical Linguistics, University of Amsterdam, Spuistraat 210, 1012 VT Amsterdam, the Netherlands. E-mail: r.j.cirillo@uva.nl.

2. The reader will notice that the floating quantifier *allen* (pronounced *alle*) differs morphologically from its non-floating counterpart *al*. A similar phenomenon occurs in German. A discussion of this is beyond the scope of this article. Also, as most readers will know, the floating *allen* has for the most part been replaced with the adverbial *allemaal* in modern Dutch.
3. My thanks to Mara van Schaik-Rădulescu for helping me develop the Romanian data.
4. See for example Den Besten (1986) and Biberauer (2008).

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